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Technical Notes

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BARTT PRECISION SEEDER TRIAL

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INTRODUCTION

Aerial broadcasting of tree seed has been very effective in regenerating jack pine (*Pinus banksiana* Lamb.) and black spruce (*Picea mariana* (Mill.) B.S.P.) in some parts of Ontario, notably the northwest. Although aerial seeding is considered to be a low cost regeneration method, it does have some disadvantages which precision seeding could help to alleviate, namely:

a) Aerial seeding uses large amounts of seed (between 35 000 and 50 000 per hectare with jack pine and up to 100 000 per hectare with black spruce) to compensate for seed landing on unsuitable seedbeds. Precision placement of seed directly onto scarified seedbeds will reduce the numbers of seed required.

b) Although aerial seeding is relatively inexpensive, the seed is costly and in some cases difficult to collect. When genetically improved seed is used it will not be acceptable to scatter it about unsuitable seedbeds. Again, the precision placement of seed will reduce the number required, consequently reducing the cost of seed.

c) Aerial seeding provides some degree of between-row spacing by relying on the location of scarified seedbeds but no within-row spacing control. Precision seeding should provide spacing control both between and within rows.

d) Aerial seeding is normally conducted during the winter following site preparation. This is an operational consideration since the seeding window is several months and suitable aircraft are readily available. Simultaneous site preparation and seeding will give new seedlings a one year advantage over winter seeded trees in terms of competing with other plant species in the seedbed.

One precision seeder that has been under development in northwestern Ontario is the Bartt Precision Seeder for disc trench scarifiers (Davidson 1991). The seeder is designed and manufactured by Bartt Forestry Equipment of Concord, Ontario. A previous report of the Silvicultural Equipment Development Committee of the Ontario Ministry of Natural Resources had recommended some improvements to the machine (Pilkey 1988). These improvements were made by the manufacturer and an operational trial was established in June of 1989 in the Wabigoon Forest near Ignace, Ontario. This report summarizes second year results from this trial.

PURPOSE OF THE TRIAL

The trial was established to determine whether, in an operational setting, the Bartt precision seeder could make a significant difference upon the stocking of jack pine when compared to a control no-seeding treatment.

Trial Area

The trial area is located on the Marneigwess Road 12 km west of Ignace, Ontario (Figure 1). A 12 ha block located on the side of a large "jack pine sand flat" cutover was chosen because it could be easily isolated from the main block and avoided when the follow-up aerial seeding was conducted.

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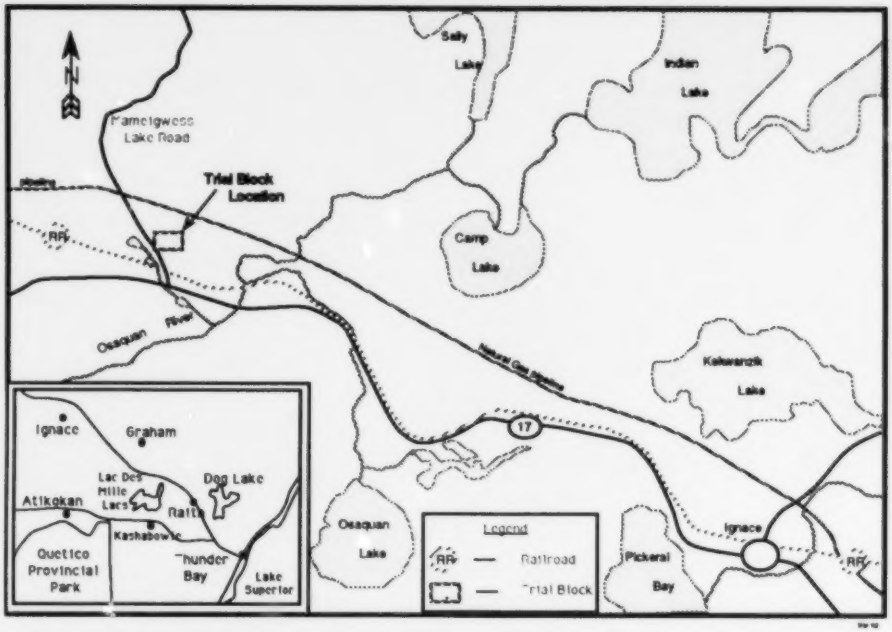

Figure 1. Map showing approximate location of the study area.

The soil is a deep, loamy, very fine sand with a fresh moisture regime and no mottles. It is classified as a soil type 1 according to the Forest Ecosystem Classification (FEC) system for Northwestern Ontario (Sims *et al.* 1989). The site index is 17.2 metres (± 0.3 metres) at age 50 (Racey *et al.* 1989). The pre-harvest NWO FEC vegetation type was V29 (Jack Pine Ericaceous Shrub Feathermoss).

Trial Design

The trial was intended to be operational in nature and therefore became part of a normal regeneration treatment conducted by Canadian Pacific Forest Products Ltd. under silvicultural agreement with the Ontario Ministry of Natural Resources. The stand was full tree harvested, the trees delimbed at the roadside and some of the slash piles burned. Site preparation was conducted in June 1989 with a Franklin skidder pulling Donaren disc scarifiers. The Bartt seeder unit was installed onto the skidder and set up by a representative from Bartt Forestry Equipment.

Calibration of the seeder showed approximately 250 seeds per 100 lineal metres of pass equating to approximately 12 500 seeds per hectare (unadjusted for viability). Germination tests showed seed viability at 88% with no difference between seed passed through the machinery and that which did not.

The seed delivery hoses were shortened after the first replication because they were flopping about too much. They were cut off at the mouth of the supporting bracket welded to the disc hub housing of the scarifier. This small change resulted in an improvement in the amount of germination recorded in the subsequent two replications.

There were two treatments, seeder off and seeder on. The control (seeder off) treatments were randomly selected areas of three passes (6 rows) where the seeder was turned off. Otherwise, the seeder was operating throughout the trial.

Six control and six "seeder on" measurement blocks were established. Within each block, twelve 4 m^2 plots (2 m X 2 m) were set out to straddle the furrow so as to include both the scarified furrow and unscarified ground within each plot. A total of 48 m^2 was therefore sampled within each measurement block, and a total of 144 plots established for the entire study (12 plots/block X 12 blocks).

For analysis, the twelve blocks were arranged into six treated/untreated pairs of "assessment units". Two assessment units, a total of four blocks were then combined into one replication (Figure 2).

Within each 4 m^2 plot, the number of seedlings in the furrow, outside the furrow and the total number of seedlings in the plot were recorded after one and two growing seasons. In Ontario, a 4 m^2 plot is stocked if it contains one or more healthy seedlings (Skinkle 1990).

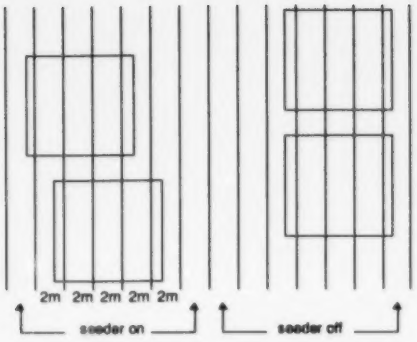

Figure 2. Schematic layout of one replicate of the trial showing two assessment units and four blocks. Each block contained 12, 4 m² plots. Each vertical line represents a furrow. Distance between the treatments was random.

Measurements were made after one and two growing seasons (12 October, 1989 and 25 September, 1990). It was not expected that first year results would be significant as all jack pine seed does not typically germinate in the first season (Fowells 1965). For this reason emphasis is placed upon the second season results.

A T-test was used to determine significant differences in stocking and density between treatments.

RESULTS AND DISCUSSION

The Bartt Precision Seeder significantly increased both stocking and density of jack pine regeneration compared to control (Table 1).

Precision seeding at the rate of 12 000 seeds per hectare provided 32% more stocking (56-24) and 1 319 more trees per hectare (2187-868) over the control treatment after two years. This rate of seeding is not necessarily recommended, but if a density of 2 000 to 2 500 trees per hectare is desired (as is common) this objective would have been met. However, even if a density of 2 187 trees per hectare is acceptable, the stocking of 56% indicates that the distribution of trees is slightly clustered in an undetermined part of the trial area. Ideal results would have stocking closer to 80% with the same number of trees per hectare.

Table 1. Stocking (%) and density (stems/ha) of jack pine seedlings in Bartt seeded and control areas two growing seasons after treatment. Results are based on total number of seedlings within the 4 m² plots.

		Treatment			
		Bartt Seeded		Control	
Replication	Assessment Plot	Stocking (%)	Density (sph)	Stocking (%)	Density (sph)
1	1	25*	833*	17	416
	2	58	2083	33	1041
2	1	67	2292	17	416
	2	67	3750	25	625
3	1	50	1666	33	2083
	2	67	2500	17	625
	Mean	56[a]	2187[c]	24[b]	868[d]
	Std. Dev.	17	966	8	637

* low number assumed to be due to delivery hoses flopping about before being cut shorter.
[a,b] significantly different at $a = 0.05$
[c,d] significantly different at $a = 0.05$

It may be possible to increase the rate of application of seed in order to increase stocking. Densities up to 3 000 stems per hectare are probably quite acceptable and tests will have to be conducted to determine what rates of precision seeding will produce acceptable densities.

Stocking within the furrows averaged 51% for seeded areas and 15% for control areas. In contrast, stocking on the unscarified ground between the furrows was only 7% on the seeded areas and 10% on the control areas. This indicates that the Bartt seeder successfully directed seed onto the desired microsite, the scarified furrow. The average stocking within the furrow would probably have been even greater had the delivery hoses been shortened before the first replication.

Results from a recent experimental trial using the Bartt MKIV seeder on shallow to bedrock, rolling terrain near Kenora, Ontario, showed that unless certain minimum power requirements can be met by the prime mover, the Bartt seeder will have trouble consistently delivering seed when the prime mover is travelling uphill (Dominy 1991). This should not have been a problem at this Ignace trial since it is a flat, sandy outwash site.

Stocking and density of the control areas at 24% and 868 trees per hectare, respectively are interesting to note as an indication of the amount of regeneration that may be expected naturally from a full-tree harvested jack pine site two growing seasons after disc trenching. Stocking and density will likely increase for a few more years as a result of seed releasing from jack pine cones left on-site after logging.

The trial will be remeasured at year five to update these findings. In addition, the adjacent portion of the cutover that received aerial seeding after disc trenching will be measured to allow for a comparison in five-year stocking levels among: 1) this broadcast (and commonly used) method of artificial regeneration, 2) the technique of precision seeding using the Bartt seeder, and 3) natural regeneration on unscarified ground.

SUMMARY

Two-year results show that the Bartt Precision Seeder significantly increased both stocking and density of jack pine seedlings compared to control (unseeded) areas on a 'jack pine sand flat' in northwestern Ontario.

ACKNOWLEDGMENTS

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